

METHOD OF AND APPARATUS FOR ACCORDION FOLDING OF ENDLESS WEBS**SPECIFICATION****FIELD OF THE INVENTION**

Our present invention relates to a method of and to an
5 apparatus for the accordion folding of endless webs of foldable
material, especially paper and, more particularly, webs which
have equidistant grooves subdividing the web into segments or
panels and wherein the web is advanced at a certain speed and as
a result of the accordion folding, each two panels connected by a
10 groove at a fold, lie one upon the other.

BACKGROUND OF THE INVENTION

Certain materials, generally referred to as endless
webs or continuous webs, must be folded for handling, storage or
the like, especially if the material is such that it cannot be
15 effectively bent and thus stored in a roll without damage. This
is the case, for example, with single layer or multilayer
corrugated paper and like materials. Such webs are generally
collected in the form of accordion-folded products.

In the past it has been the practice to form fold lines
20 along the transverse grooves of the web and to bend the web at
the fold line by hand. The upper panel is then pressed down upon
the lower panel. The bending of the web to form the fold is

usually assisted by driving a bar of wood against the web in the region of the groove.

Obviously this approach requires considerable effort and personnel. Furthermore, an exact folding along a groove cannot always be ensured so that, as a general matter, the
5 accordion folding can be somewhat ragged or of insufficient precision.

OBJECTS OF THE INVENTION

It is therefore the principal object of the present
10 invention to provide an apparatus and a method of forming accordion-folded webs whereby the earlier drawbacks can be avoided and the accordion folding of a continuous web can be effected automatically and with a high degree of precision.

Another object of the invention is to provide a method
15 of according folding a continuous web in which the accordion-folded product has a high degree of reproducibility and accuracy.

Another object of the invention is to provide an improved apparatus for accurately according folding a continuous web.

SUMMARY OF THE INVENTION

20 These objects and others which will become apparent hereinafter are attained, in accordance with the invention in a method of accordion folding a continuous web of foldable material having a succession of equidistant grooves formed therein and

separating panels of the web from one another. The method comprises the steps of:

(a) advancing the web longitudinally at a speed of advance;

5 (b) lifting the web in a region of each second groove, advancing the second groove at a speed matched to the speed of advance to forcibly fold the web at the second groove, and depositing a fold formed in the web at the second groove; and

(c) repeating step (b) after depositing each fold
10 formed therein to collect the web as an accordion-folded set of the panels.

The web can be lifted exactly at each second groove or only in the region thereof. The entrainer or lifter can extend across the web and can be a wire or strand engaged at its ends in
15 rollers or like members traveling in guides at opposite sides of the web. Important to the invention is that, as the web is advanced along its path, each second groove is lifted along a linear, upwardly inclined path to a peak height and then, in the form of a fold between the leading panels and the trailing panel,
20 at the respective second groove, is brought down again toward the original path or plane of the web so as to fold two panels one over the other and deposit an accordion-folded product. The downward path is preferably a circular arc segment.

BRIEF DESCRIPTION OF THE DRAWING

The above and other objects, features, and advantages will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

5 FIG. 1 is a diagrammatic side elevation of an apparatus for carrying out the method of the invention;

 FIG. 2 is an illustration of an lifter or entrainer which is engageable with the web for folding same;

 FIG. 3 is a diagram illustrating the invention;

10 FIG. 4 is a cross sectional view through the web;

 FIG. 5 is a diagram showing the guide system for the arc segmental phase of the movement of the lifter or entrainer; and

 FIG. 6 is a view similar to FIG. 5 of another guide arrangement.

15

SPECIFIC DESCRIPTION

The foldable material is fed in the direction of the arrow 1 as an endless or continuous web with certain speed in the direction of advance. That displacement can be continuous or
20 discontinuous and the means for displacing the web can be a conveyor or drive system represented at 45 in FIG. 1.

The web can be fed along a guide 2 to an abutment 3 and two positions of the guide and abutment are shown at 2 and 3 in FIG. 1 or at 2a and 3a in FIG. 1 to indicate that the guide and
25 abutment may be height adjustable.

As can be seen from FIG. 4, for example, the web 10 may be a corrugated paper sheet which can comprise a core 11 which can be of corrugated paper, sandwiched between cover sheets 12 and 13. Panels 14 and 15 are separated along the web 10 by grooves 16 formed in the web. As can be seen from FIG. 3, the grooves 16 may be located equidistantly from one another to define the panels 14 and 15, for example, between them. When one of these grooves, for example, the groove represented at 16' in FIG. 3, is lifted by a lifter or entrainer represented at 20 and, as the web continues to move to the left in FIG. 3, this groove is initially guided upwardly in a linear path to a peak height and then is lowered along a circular arc segmental portion of the path, an accordion-folded stack can be formed as shown at 17 in FIG. 3.

In FIG. 2, the lifter or entrainer is shown as a member 48 which is in tension between two rollers 49 guided in sheet metal channels 47 on opposite sides of the web.

In other words, along the opposite sides of the web, guides 4 are provided which are spanned by the lifter 48 and can be the rollers 49 which are chained together in endless chains. The pair of these endless chains may define an initial straight line upward inclination 41 for the entrainer or lifter which transitions to an approximately circular arc segmental path 42. The lifters are then returned to their starting points over the linear segments 43.

With this form of guiding, each second groove is lifted in the region of the groove generally or exactly at the groove and automatically is forcibly folded until it is laid down again in the accordion-folded stack. During the movement of the
5 circular arc segmental section 42, the two panels ahead of and behind the fold lie form an acute angle.

The spacing of the lifters or entrainers 48 in their respective conveyor chain can be variable to accommodate different fold lengths and the positions of the two guides can be
10 varied as well to accommodate different widths of the web. The guides during the arcuate movement can be crossed arms 50 (FIG. 5) or rotary disks 51 (FIG. 6).